

SUNET - A Swedish University Network

Progress report 1980/81

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The SUNET project

The Swedish Board for Technical Development has awarded a grant for the establishment of a computer network as part of its programme for research in information processing and computer science (1). The objectives of the project are:

- to provide good communication facilities for the attached research laboratories and computing centers in order to promote interregional cooperation and resource sharing.
- to provide a test vehicle for research in high-level protocols for computer-to-computer communication.

The services to be provided by the network are the following:

- interactive access to host computers for asynchronous terminals with a line speed of 300 - 2400 baud
- file transfer service between connected host computers
- "electronic mail" by interconnection of the local computer-based mail and teleconferencing systems

The project started in mid 1980 (2). The Sunet network consists of a packet-switched network based on the CCITT X.25 recommendation. Regional X.25 switches and leased public telephone lines provide the basis for regional networks in each of the six university regions connecting local hosts. The six switches are connected via the Swedish public X.25 service Telepak.

A steering committee has been appointed for the project. It consists of the following persons:

| | |
|--------------------|----------------|
| Hans Nilsson | Project leader |
| Bengt Olsen | QZ |
| Björn Pehrson | Teknikum |
| Torsten Ström | LIDAC |
| Sven Tafvelin | CTH |
| Lars-Erik Thorelli | KTH |
| Hans Wallberg | UMDAC |
| Bengt Åkesson | Televerket |

The project will end 1982-06-30. At that time, approximately 30 computers will be connected to the network.

Personnel involved

The following persons are actively working in the project:

| | |
|----------------------------|--------------------------|
| Hans Nilsson, KI | project leader |
| Björn Pehrson, Teknikum | ass. project leader |
| Rikard Wikström, Teknikum | Network establishment |
| Pär Eriksson, Teknikum | File transfer |
| Ulf Bilting, CTH | Mail and message systems |
| Thomas Sjöland, KI and KTH | Transport Service |

All persons are engaged half-time in the project.

In June 1980 an invitation to tender was distributed to vendors of data communication equipment. During the autumn the received proposals were evaluated (3). In december the decision was made to buy X.25 switches from TRT, a Philips owned french company. Each switch consists of a X.25 switch and a PAD for connection of asynchronous terminals. In some regions there already exist, or will exist, terminal networks which will be connected to the PADs.

The first two switches were delivered in May 1981 and were thoroughly tested in Uppsala. One of the switches was then installed in Stockholm. The remaining four switches have just been delivered and are under test.

In order to simplify the connection of host computers to the network, a portable X.25 line monitor has been developed in the project. One line monitor will be available at each switch site and can be borrowed by any institution taking part in the project.

Host computer X.25 support

Some, but not all, computer manufacturers have X.25 support available. Presently most of the manufacturers represented at swedish universities will be able to supply X.25 hardware and software. At this moment the situation is the following:

- Control Data can provide X.25 hardware and the software for incoming terminal traffic. A user group has had fruitful discussions with CD on design issues.
- DEC can provide complete support for some of their models (e.g. Vax/VMS). DEC10/DEC20 will remain problematic. Different user-developed solutions for different installations are being developed. Some of them are in the form of gateways (see below).
- DEC computers running under Unix can connect to Sunet via the LSI11-based SNIP developed at KTH.
- IBM can presently provide X.25 only for Series/1.
- Norsk Data have an almost complete support. Remaining deficiencies will be remedied shortly. Well established cooperation exists between Norsk Data and several user groups.
- Prime offers a complete X.25 support. The possibility to influence Prime is good.
- Univac is working on the problem. No time schedule has been given. A nordic user group have had talks with Univac.

High level protocol development

The ISO basic reference model for Open Systems Interconnection (OSI) is adopted as a basis for high level protocol development. The intention is also to use established protocol standards as far as possible. It was therefore decided to use the following protocols initially:

- ECMA/ISO Transport protocol
- Uninett File Transfer Protocol
- GILT standards for interconnecting computer-based message systems

A draft description of services and protocols for Sunet can be found in appendix 1.

For the first layer above X.25, the Transport Layer, a portable Pascal implementation of the recommended protocol is being developed.

Gateways

Some of the computer systems that cannot easily be connected directly to Sunet because of lack of X.25 support from the manufacturer are DEC10s and DEC20s that already are integrated in some sort of network.

In Linköping several DEC computers are tied together by Decnet. Therefore a gateway between Decnet and Sunet implemented in a PDP 11/23 is planned. The work will be done in cooperation with Digital Equipment.

In Uppsala a DEC2060 is connected to four LMI LISP-machines via an ethernet-based local network named Chaosnet. The plans are to connect this local network to Sunet via a Gateway.

The DEC10 at QZ is interfaced via a Nord-12 computer with software from the University of Oslo.

Nordic cooperation: NORDUNET

Both in Denmark and Norway data communication network projects started several years before the work started in Sweden (Centernet in Denmark, Uninett i Norway).

It is already possible to reach Uninett from Sunet since the public X.25 services in Sweden (Telepak) and Norway (Norpak) are connected.

In Finland, a network project has been initiated at the Computer Centre of the University of Helsinki.

The Nordunet Conference has been held two times, in Tällberg (Sweden) in august 1980 and in Copenhagen June 1981. Norway will host the conference in May 1982 and Finland 1983.

In the framework of Nordunet, the Nordic network projects are also cooperating in defining common high level protocols. Another joint activity is to establish pressure groups for negotiating with computer manufacturers to supply X.25 support

European cooperation: COST-11-bis

The european scientific cooperation programme (COST) has for many years pointed out data communication as an area where cooperation should be promoted. The first project, now finished, in this area was the EIN European Informatics Network. It gave basic knowledge which has been used to establish Euronet, now connected to national public X.25 networks. The Swedish public X.25 service Telepak will be connected to Euronet shortly.

COST-11-bis is a new data communication cooperation project where the following subprojects have been started so far (swedish representatives are specified):

- Working group for Transport Station design (WGT)
- File Transfer Protocols (FTP): Pär Eriksson UU
- Mail systems (GILT): Ulf Bilting CTH, Jacob Pame FOA
- Formal Description Techniques (FDT):
Rune Gustavsson, Bengt Jonsson UU
- Local networks: Tomas Ljungfelt, KTH

The aim of the GILT project is to achieve full inter-connection of a number of independent Computer Based Message Systems (for example the KOM system) by means of X.25 packet switched networks.

Taking part in the Cost-11-bis cooperation has lead to many valuable contacts within the european research community. We are presently investigating the possibilities of taking part in other sub-projects. Of special interest is the area of Formal Description Techniques and Verification of protocols.

The future for SUNET

We are quite confident that the technical problems of establishing a physical network for SUNET and connecting host computers to the network are under control. Most computer manufacturers are now supporting or have announced support for X.25. There is however much work to be done in the area of high-level protocols, both in defining protocols and implementing them in the hosts.

Local networks will come in more general use within a few years. Activities in this field is planned at several swedish research groups.

Satellite links may be used especially to transmit large files at high speeds between distant areas. We are following ongoing activities in this field and keep into contact with the groups planning for the swedish Tele-X satellite.

The Sunet network is now run as a research project. In the future, some form of organization must be established to operate the physical network as well as developing the high-level protocols according to international standards.

All communication costs are now payed centrally by the project. In the future, we either have to find financing for operating the network as a free resource for the research community, or the end users will have to bear their communication costs.

The future of the Sunet project is presently the most important issue for the project's steering committee.

References

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